International Journal of Reproduction, Contraception, Obstetrics and Gynecology
Vodouhe TYS et al. Int J Reprod Contracept Obstet Gynecol. 2025 Nov;14(11):3660-3666
www.ijrcog.org
pISSN 2320-1770 | eISSN 2320-1789

DOI: https://dx.doi.org/10.18203/2320-1770.ijrcog20253504

Original Research Article

Prevalence and associated factors of preeclampsia in two national university hospitals in Cotonou in 2024

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Received: 08 September 2025
Accepted: 07 October 2025

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ABSTRACT

Background: Preeclampsia is one of the direct obstetric complications with a heavy burden, particularly in low- and middle-income countries such as Benin. The objective of this research was to identify the determinants of preeclampsia among pregnant women managed in two national university hospitals in Cotonou in 2024.
Methods: The study was conducted in two university hospitals in Cotonou. It was a matched case-control study (two controls for each case), with an analytical aim and prospective data collection from August to October 2024. The threshold for retaining variables in the bivariate analysis was 0.2. Multivariate analysis consisted of a stepwise descending binary logistic regression with a significance level of 0.05.
Results: A total of 120 cases of preeclampsia and 240 controls were surveyed. The hospital prevalence of preeclampsia was 11.11%. The mean age was 27.64±6.32 years versus 27.35±5.72 years. Most participants had secondary education (33.33% versus 42.50%) and were nulliparous (45.83% versus 35.42%). The majority of cases were referred (84.17%). Preeclampsia had several determinants: acceptance of the pregnancy by the partner (p=0.013), recent change of partner (p<0.001), existence of stress during pregnancy (p=0.006), nulliparity (p = 0.034), difficult living conditions (p=0.014), place of antenatal care (p<0.001), and multiple pregnancies (p=0.002).
Conclusions: Identifying the determinants of preeclampsia will make it possible to target appropriate interventions and preventive measures to reduce its incidence, tailor antenatal care, and improve the maternal and perinatal prognosis of this condition.

Keywords: Associated factors, Cotonou, Preeclampsia, Pregnancy, Prevalence

INTRODUCTION

Preeclampsia is a direct obstetric complication of multifactorial origin and complex pathophysiology. Its prevalence is estimated at between 2% and 8% of pregnancies worldwide.[1] It represents a major public health issue with a heavy burden: preeclampsia is indeed the leading cause of combined fetal and maternal morbidity and mortality.[1] Its curative treatment consists of terminating the pregnancy and delivering the placenta. In its early forms, induced preterm delivery leads to neonatal morbidities, whereas prolongation of the pregnancy exposes both the mother to severe maternal complications and the newborn to perinatal complications. The reduction of mortality associated with preeclampsia is possible through early detection during prenatal care and appropriate management, which requires an understanding of the risk factors for this condition.[2] This is the rationale

for this study, whose objectives were to estimate the prevalence and identify the factors associated with preeclampsia among patients managed in two university referral hospitals in Cotonou in 2024.

METHODS

The study was conducted at the University Clinic of Gynecology and Obstetrics (CUGO) of the Hubert Koutoukou Maga National University Hospital Center (CNHU-HKM), and the Mother's Unit of the Lagoon Mother and Child University Hospital Center (CHU-MEL) in Cotonou. It was a case-control study with prospective data collection from June to December 2024. Cases were pregnant women, women in labor, and postpartum women diagnosed with preeclampsia according to the revised definition of the International Society for the Study of Hypertension in Pregnancy (ISSHP), namely the onset, from 20 weeks of amenorrhea, of high blood pressure (systolic ≥140 mmHg and/or diastolic ≥90 mmHg) associated with at least one of the following conditions: significant proteinuria (≥2+ on urine dipstick or ≥300 mg in a 24-hour urine collection) or, in the absence of proteinuria, the presence of maternal organ dysfunction (neurological complications, pulmonary edema, hematologic complications, liver involvement, or acute kidney injury) and/or uteroplacental dysfunction.[3] Controls were pregnant women, women in labor, and postpartum women without any hypertensive disorder of pregnancy. Each case was matched with two controls based on the hospital center, age group (±5 years), and gestational age (±1 week of amenorrhea). We included cases and controls managed during the study period who provided free and informed consent to participate. Case sampling was exhaustive. The dependent variable was preeclampsia, while independent variables were related to Sociodemographic characteristics, personal and family medical history, lifestyle habits, prenatal follow-up, and clinical data. In the descriptive analysis, we estimated the mean and its standard deviation, or the median and interquartile range for quantitative variables, depending on whether the distribution was symmetrical or not; for qualitative variables, we presented the sample sizes and calculated the proportions. In the bivariate analysis, we investigated the association between preeclampsia and independent variables by comparing proportions using Pearson's Chi-square test or Fisher's exact test, with a significance threshold of 0.05. The retention threshold for explanatory variables in the multivariate analysis was 0.2. In the multivariate analysis, we performed a stepwise backward binary logistic regression, including in the initial model the independent variables showing an association with preeclampsia in the bivariate analysis (retention threshold 0.2), then progressively removing non-statistically significant predictors. The strength of the association was assessed using the adjusted odds ratio (aOR) with its 95% confidence interval (95% CI); a significance level of 5% (p value <0.05) was retained. The validity of the final model was evaluated using the Hosmer-Lemeshow goodness-of-fit test.

RESULTS

Prevalence

A total of 120 cases of preeclampsia and 240 controls were surveyed. The hospital prevalence of preeclampsia was 11.11%.

Sociodemographic characteristics

The mean age of the cases was 27.64±6.32 years, compared with 27.35±5.72 years for the controls. Most respondents were self-employed (62.50% versus 61.25%) and were married or in a common-law union (89.17% versus 92.08%). Similarly, 42.50% of cases and 33.33% of controls had a secondary education level. Sociodemographic characteristics are presented in Table 1.

Table 1: Distribution of cases and controls according to socio-demographic characteristics at CNHU-HKM and CHU-MEL of Cotonou, 2024.

	Cases		Controls		Total	
	N	%	N	%	N	%
Age group (years)	120	100	240	100	360	100
15-25	50	41.67	100	41.67	150	41.67
25-35	55	45.83	122	50.83	177	49.17
35-46	15	12.50	18	7.50	33	9.17
Occupation	120	100	240	100	360	100
Civil servant	14	11.67	50	20.83	64	17.78
Worker/artisan	75	62.50	147	61.25	222	61.67
Student/pupil/apprentice	10	8.33	19	7.92	29	8.06
Housewife	21	17.50	24	10.00	45	12.50
Marital status	120	100	240	100	360	100
Single	13	10.83	19	7.92	360	8.89
Cohabiting/married	107	89.17	221	92.08	328	91. 11

Table 2: Distribution of cases and controls according to obstetric history and pregnancy circumstances at CNHU-HKM and CHU-MEL, Cotonou, 2024.

	Cases		Controls		Total	
	N	%	N	%	N	%
Gravidity	120	100	240	100	360	100
Primigravida	45	37.50	64	26.67	109	30.28
Paucigravida	39	32.50	110	45.83	149	41.39
Multigravida	24	20.00	50	20.83	74	20.56
Grand multigravida	12	1000	16	6.67	28	7.78
Parity	120	100	240	100	360	100
Nulliparous	55	45.83	85	35.42	140	38.89
Primiparous	21	17.50	67	27.92	88	24.44
Pauciparous	25	20.83	64	26.67	89	24.72
Multiparous	16	13.33	21	8.75	37	10.28
Grand multiparous	3	2.50	3	1.25	6	1.67
Number of fetuses	120	100	240	100	360	100
1	111	92.50	230	95.83	341	94.72
≥2	9	7.50	10	4.17	19	5.28
Mode of conception	120	100	240	100	360	100
Natural	119	99.17	233	97.08	352	97.78
Medically assisted reproduction	1	0.83	7	2.92	8	2.22
Pregnancy recognition by partner	120	100	240	100	360	100
No	8	6.67	2	0.83	10	2.78
Yes	112	93.33	238	99.17	350	97.22
Primipaternity	120	100	240	100	360	100
No	37	30.83	172	71.67	209	58.06
Yes	83	69.17	68	28.33	151	41.94
New partner	120	100	240	100	360	100
No	98	81.67	214	89.17	312	86.67
Yes	22	18.33	26	10.83	48	13.33
Pregnancy-related stress	120	100	240	100	360	100
No	83	69.17	185	77.08	268	74.44
Yes	37	30.83	55	22.92	92	25.56

Table 3: Data related to preeclampsia at CNHU-HKM and CHU-MEL, Cotonou, 2024.

	N	%
Severity	120	100
Moderate preeclampsia	20	16.67
Severe preeclampsia	100	83.33
Maternal complications	120	100
None	73	60.83
Eclampsia	26	21.67
Retroplacental hematoma	14	11.67
Acute pulmonary edema	2	1.67
HELLP syndrome	6	5.00
Acute renal failure	5	4.17
Perinatal complications	131	100
None	39	29.77
Prematurity	39	29.77
IUGR[1]	24	18.32
IUFD[2]	19	14.50
Acute fetal distress[3]	10	7.63

[1]IUGR: Intrauterine growth restriction; [2]IUFD: Intrauterine fetal death; [3]Acute fetal distress.

Table 4: Factors associated with preeclampsia in multivariate analysis among surveyed women at CNHU-HKM and CHU-MEL, Cotonou, 2024.

	aOR[1]	95% CI[2]	P value
New partner (primipaternity)			
No	1	-	
Yes	4.59	2.57-9.57	<0.001
Pregnancy-related stress			
No	1	-	
Yes	6.57	1.86-18.47	0.006
Parity			
Pauciparous	1	-	
Nulliparous	4.91	1.48-9.47	0.034
Primiparous	1.38	0.55-3.25	0.394
Multiparous	68.58	4.57-95.84	0.019
Grand multiparous	14.33	0.17-28.63	0.249
Difficult living conditions			
No	1	-	
Yes	16.52	9.84-62.82	0.014
Place of antenatal care			
University teaching hospital (UTH[3])	1	-	
District hospital (DH[4]) / departmental hospital center (DHC[5])	8.44	1.89-14.73	<0.001
Private clinic/office	96.17	24.75-114.20	<0.001
Public health center (PHC[6])	16.95	12.58-32.04	<0.001
Pregnancy recognition by partner			
No	1	-	
Yes	0.58	0.61-0.96	0.013
Multiple pregnancy			
No	1	-	
Yes	0.54	0.36-0.84	0.002

[1]aOR: adjusted odds ratio; [2]95% CI: 95% confidence interval; [3]UTH: university teaching hospital; [4]DH: district hospital; [5]DHC: departmental hospital center; [6]PHC: health center.

Obstetric history and pregnancy circumstances

Cases were primarily primigravida (37.50%) and nulliparous (45.83%), whereas controls were mostly paucigravida (45.83%) and nulliparous (35.42%). Conception was natural in 99.17% of cases versus 97.08% of controls, and the partner was not new in 81.67% versus 89.17%, respectively. Among cases, 84.17% were referred patients, compared with 32.50% of controls. Obstetric history and pregnancy circumstances are presented in Table 2.

Data related to preeclampsia

Preeclampsia was severe in 83.33% of cases and moderate in 16.67% of cases. Its main maternal complications were eclampsia (21.67%) and retroplacental hematoma (11.67%), while perinatal complications included intrauterine fetal death (15.83%) and induced prematurity (15.83%). Data related to preeclampsia are presented in Table 3.

Factors associated with preeclampsia

Multivariate analysis identified several independent factors associated with preeclampsia. The risk factors were: primipaternity [p<0.001; aOR=4.59; 95% CI (2.57-9.57)], stress during pregnancy [p=0.006; aOR=6.57; 95% CI (1.86-18.47)], nulliparity [p=0.034; aOR=4.91; 95% CI (1.48-9.47)], multiparity [p=0.019; aOR=68.58; 95% CI (4.57-95.84)], pregnancy follow-up outside university hospitals (p<0.001), and difficult living conditions [p=0.014; aOR=16.52; 95% CI (9.84-62.82)]. Protective factors included the partner's acceptance of the pregnancy [p=0.013; aOR=0.58; 95% CI (0.61-0.96)] and multiple pregnancies [p=0.002; aOR=0.54; 95% CI (0.36-0.84)]. Factors associated with preeclampsia are presented in Table 4.

DISCUSSION

Prevalence of preeclampsia

The hospital prevalence of preeclampsia was 11.11%. This rate is higher than those reported in central Ghana (8.8%), at the University Hospital of Jos in Nigeria (8.8%), in Germany (2.31%), in Norway (3%), and well above the global prevalence, which ranges between 2% and 8%.[1,2,4-6] Our study was conducted in two tertiary hospitals (level III), characterized by the concentration phenomenon of severe pathologies, which may explain the high prevalence observed. Other studies have reported even higher

prevalence than in our research, notably in Ethiopia (12.4%), in Nigeria (16%), and up to 28% in India.[7-9] According to a large-scale epidemiological study, the prevalence of preeclampsia was 0.5-2.3% in Africa, 0.2-6.7% in Asia, 2.8-5.2% in Europe, 2.8-9.2% in Oceania, 1.8-7.7% in South America and the Caribbean, and 2.6–4.0% in North America.[10] This large-scale study covered vast samples, which may account for the lower prevalence reported. Overall, the frequency of preeclampsia varies greatly according to regions and periods. Differences in population characteristics, context and study methods, and seasonal variations may explain these disparities.[1,10]

Sociodemographic and obstetrical characteristics of pre-eclamptic women

Pre-eclamptic women had a mean age of 27.64±6.32 years, with most falling within the 25 to 35 years age range (45.83%). A similar age has been reported by several authors, including Diallo et al in Guinea-Conakry in 2022 (26-35 years), Logan et al in Kenya in 2020 (27.6 years), and Smiti et al in Morocco in 2021 (27.2 years).[11-13] The level of education was low: 25% of pre-eclamptic women had no formal schooling and 24.17% had only primary education (a combined frequency of 49.17%), even though the majority resided in Cotonou and surrounding areas, in urban settings. Likewise, they were mainly workers and artisans (62.50%). Lower proportions of women with low education levels were reported in the studies by Khanum et al. in Bangladesh in 2021 (30.99%) and Logan et al. in Kenya in 2020 (27.2%).[12,14] From an obstetric standpoint, they were mostly primigravida (37.50%) and nulliparous (45.83%). Other authors, such as Diallo et al in Guinea, Reyes et al in Colombia, and Khanum et al in Bangladesh, reported proportions of primigravida of 34.41%, 36.8%, and 35%, respectively, relatively close to our observations.[11,14,15] In the research of Essome et al in Cameroon and Benjelloun et al in Morocco, nulliparous women were predominant, with proportions of 46.7% and 57%, respectively.[16,17]

Factors associated with preeclampsia

Among the factors associated with preeclampsia, both risk factors and protective factors were identified.

Risk factors included primipaternity [p<0.001; aOR=4.59; 95% CI (2.57-9.57)], parity- specifically nulliparity [p=0.034; aOR=4.91; 95% CI (1.48-9.47)] and multiparity [p=0.019; aOR=68.58; 95% CI (4.57-95.84)], the presence of stress during pregnancy [p=0.006; aOR=6.57; 95% CI (1.86-18.47)], difficult living conditions [p=0.014; aOR=16.52; 95% CI (9.84-62.82)], and the place of antenatal care, particularly follow-up outside of a university teaching hospital (p<0.001). The majority of preeclampsia cases occur during a first pregnancy or in subsequent pregnancies when there is a change of partner. Indeed, nulliparity and primipaternity are risk factors for preeclampsia due to poor immunologic tolerance, involving abnormal maternal recognition of the fetoplacental unit, or poor recognition of paternal antigens by the maternal organism, particularly in cases involving condom use, infrequent sexual intercourse before pregnancy, or intrauterine insemination with donor sperm.[18] Several studies have identified primigravidity as a risk factor for preeclampsia, while others have not.[1,5,10,19]

Women who experienced stress during pregnancy were 6.57 times more likely to develop preeclampsia than those who did not [p=0.006; aOR=6.57; 95% CI (1.86-18.47)]. Similar findings were reported by Leeners et al.[20] A high level of stress induces a pro-inflammatory state with the release of pro-inflammatory cytokines, interleukin-6, and cortisol, as well as increased activity of the sympathetic nervous system, all of which promote the onset of preeclampsia.[21] Chronic stress, inadequate medical follow-up, and nutritional deficiencies due to poor living conditions may explain the higher occurrence of preeclampsia among women with difficult living conditions compared to those with better circumstances [p=0.014; aOR=16.52; 95% CI (9.84-62.82)].

The place of antenatal care (p<0.001) was significantly associated with preeclampsia. Women whose pregnancies were monitored in health facilities other than university teaching hospitals (UTH) were more likely to develop preeclampsia: in district hospitals or departmental hospitals center (DH/DHC), the risk was 8.44 times higher [aOR=8.44; 95% CI (1.89-14.73)]; in private clinics, it was 96.17 times higher [aOR=96.17; 95% CI (24.75-114.2)]; and in peripheral public health centers, it was 19.95 times higher [aOR=16.95; 95% CI (12.58-32.04)]. Comprehensive and systematic assessment of personal and family medical history for each pregnant woman in UTH by qualified personnel allows identification of patients at risk for preeclampsia and implementation of preventive treatment with acetylsalicylic acid from the 12th week of amenorrhea, calcium supplementation in case of insufficient dietary intake, and management of chronic diseases favoring preeclampsia, thereby reducing its risk.[4,19,22,23] Conversely, in hospitals other than UTHs, the limited availability of skilled personnel and superficial assessment of medical history may reduce prevention quality and explain the elevated preeclampsia risk observed in this study.

Protective factors against preeclampsia identified in this study included recognition of the pregnancy by the father [p=0.013; aOR=0.58; 96% CI (0.61-0.96)] and multiple pregnancies [p=0.002; OR=0.54; 95% CI (0.36-0.84)]. Lack of recognition of the pregnancy by the partner can lead to chronic stress and marital conflict, potentially favoring the development of hypertension and preeclampsia. Furthermore, the illegitimacy of an unacknowledged pregnancy may increase the likelihood of preeclampsia due to immunologic intolerance of the maternal body to fetal antigens from a partner other than the usual one. In addition, non-recognition of the pregnancy often results in disengagement of the partner from antenatal care and pregnancy-related expenses. The

consequent inadequate prenatal follow-up may favor the occurrence of preeclampsia due to insufficient prevention.[4,19,23]

The association of multiple pregnancy as a protective factor is paradoxical to existing literature. Indeed, multiple pregnancies are recognized risk factors for preeclampsia by the WHO and have been demonstrated in several studies worldwide.[19,23-25] Participant selection methods and the limited statistical power of this study may have introduced bias leading to this finding.

CONCLUSION

The prevalence of preeclampsia is relatively high in this study. Several factors are associated with its occurrence. Identifying these risk factors will allow better targeting of at-risk pregnant women in Cotonou and adapting preventive measures to reduce the incidence of this serious obstetric complication.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the local biomedical research ethics committee of the University of Parakou (CLERB-UP)

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Cite this article as: Vodouhe TYS, Aboubakar M, Ogoudjobi M, Acakpo B, Hounsa C, Aguemon CT, et al. Prevalence and associated factors of preeclampsia in two national university hospitals in Cotonou in 2024. Int J Reprod Contracept Obstet Gynecol 2025;14:3660-6.